NON-PUBLIC?: N
ACCESSION #: 9209300002
LICENSEE EVENT REPORT (LER)

FACILITY NAME: South Texas, Unit 2 PAGE: 1 OF 08

DOCKET NUMBER: 05000499

TITLE: Automatic Reactor Trip and Safety Injection Actuation due to Low Pressurizer Pressure
EVENT DATE: 12/24/91 LER #: 91-010-01 REPORT DATE: 09/23/92

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 016

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
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COMPONENT FAILURE DESCRIPTION:
CAUSE: A SYSTEM: AB COMPONENT: PCV MANUFACTURER: W120
REPORTABLE NPRDS: NO

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On December 24, 1991, at 1644 hours, Unit 2 was operating at 30% Rated Thermal Power (RTP) when pressurizer spray valve PCV-655C failed open. This ultimately caused an automatic reactor trip and Safety Injection (SI) actuation on low pressure at 1648 hours from 16% RTP. Three Reactor Coolant Pumps (RCPs) were secured to terminate the transient. All available safety equipment performed as designed and no actual injection to the reactor occurred. The cause was disengagement of the feedback arm linkage to the valve stem connecting plate on the pressurizer spray valve controller. Locking nuts were added to the spray valve feedback arm linkage connecting screws. Corrective actions included improving maintenance work instructions, conducting plant management reviews with personnel to discuss the event, and providing training on lessons learned from the event.

DESCRIPTION OF EVENT:

At 1644 hours on December 24, 1991, while Unit 2 was at 30% Rated Thermal Power (RTP), both pressurizer spray valves were modulating to control pressure. Pressurizer heaters 2D and 2E were in the ON position, and heater 2C was in the automatic position. The feedback arm linkage on Pressure Control Valve (PCV) PCV-655C, Loop A spray valve, became disengaged from the valve stem connecting plate. This caused the available Instrument Air to be ported to the valve actuator forcing the spray valve to the open position. Spray flow increased causing the Reactor Coolant System (RCS) pressure to decrease. As pressure decreased, backup heaters 2A and 2B energized, activating a control room annunciator.

In response, a licensed operator verified that the pressurizer heaters were on, that pressure indication instruments were operating properly (reading approximately 2180 psig), and that demand on spray valves was at 0%. However, the operator noticed that the "red" open indication light was still present on both spray valves. The operator placed the two spray valve controllers in manual and verified that there was no demand on the controllers.

The operators anticipated that securing two reactor coolant pumps in the loops feeding pressurizer spray would stop the depressurization transient. The Unit Supervisor (US) and Shift Supervisor (SS) ordered a power reduction to less than 10% power to enable the two reactor coolant pumps to be tripped without generating an automatic reactor trip. A low pressurizer pressure automatic reactor trip occurred at 16% RTP and 1648 hours, before the downpower maneuver could be completed. A safety injection, accompanied by a containment isolation, also occurred at this time. RCPs 2A and 2D were stopped manually.

The operators implemented the Emergency Operating Procedures and stabilized the plant. At 1718 hours, the operators transitioned out of the Emergency Operating Procedure. The safety injection and Phase A isolation signals were reset and instrument air was resupplied to the Reactor Containment Building. Due to the mode of failure of the spray valve PCV-655C, the valve again failed open on resupply of instrument air. Pressurizer pressure dropped below the nominal safety injection setpoint but an automatic safety injection signal was not received due to

the block/reset feature of the safety injection actuation circuitry. By design, the safety injection trains were blocked when the reactor trip breakers were open and safety injection actuation had occurred.

DESCRIPTION OF EVENT: (Con't)

The operators did not manually inject safety injection because the operators were incorrectly assuming that the Emergency Operating Procedure criteria for safety injection was still applicable even though the Emergency Operating Procedure was exited earlier. RCP 2B was secured and the transient was terminated at 1742 hours. The unit was returned to normal operating pressure and temperature. At 1917 hours, the reactor trip breakers were closed which automatically reset safety injection actuation capability.

The actuation of the Safety Injection System did not inject coolant into the RCS because the minimum pressure reached was 1725 psig and the shutoff head of the High Head Safety Injection (HHSI) pumps is 1680 psig (plus 20 psig suction pressure).

Loop A spray valve, PCV-655C, was found with the feedback arm linkage disengaged from the valve stem connecting plate. Loop D spray valve PCV-655B indication limit switch was found to be out of adjustment. The feedback arm linkage on PCV-655C was reattached to the threaded connecting plate and a locking nut was added. The limit switch on PCV-655B was adjusted and a locking nut was added to the feedback arm linkage. Both spray valve controllers were then calibrated, stroked, and observed to stroke fully and smoothly. Additionally, the valve open position indication lights were verified to operate properly.

Unit 1 was inspected on December 30, 1991, and both pressurizer spray valves were found to have a similar feedback arm linkage arrangement to that found in Unit 2. On December 31, 1991, the screw on each Unit 1 spray valve linkage arrangement was replaced with a longer screw and locking nuts.

Investigation of the event identified that the last maintenance work package relevant to the spray valve feedback linkage prior to this event was worked in early December, 1991, near the end of the Unit 2 refueling outage. The work instructions did not provide specific details for how to disassemble and reassemble the feedback linkage, nor did they include a copy of the vendor manual drawing. The Configuration Change Log

indicates that the controller was disconnected and verified to be disconnected, and that upon completion of the valve work, the controller was reconnected and verified to be reconnected.

DESCRIPTION OF EVENT: (Continued)

This work package provided instructions for checking the limit switch/position indication settings for spray valve PCV-655B. The indications were verified to operate properly. Subsequent to the maintenance being performed, limit switch settings for PCV-655B went out of adjustment providing the control room with a false open signal.

The pressurizer spray valve controller attachment as-built configuration differs from the configuration depicted in the applicable vendor documentation. Although this discrepancy did not contribute directly to this event, it indicates that Station configuration management of this type of actuator should be addressed.

The time between the event initiation (2235 psig and decreasing) and the automatic reactor trip was 281 seconds. Even though power was being reduced rapidly, review determined that the operators should have initiated a manual reactor trip before the automatic system was challenged. With existing plant indications, duration of the continuing transients and need for repair of the malfunctioned spray valves, operators should have recognized the need for a conservative judgement to manually trip the reactor. Operator training emphasizes the responsibility to manually initiate a reactor trip and/or other ESF actuation to avoid relying on automatic functions.

Further review of this event has revealed that from the time that the Emergency Operating Procedures were exited to the time when the reactor trip breakers were closed, the plant was in violation of Technical Specification 3.3.2. The plant was in this Technical Specification for approximately 2 hours. The South Texas Project Technical Specifications require two of three safety injection automatic circuits to be operable in Modes 1 through 4. All safety injection trains were blocked due to the safety injection block design feature when the reactor trip breakers are open.

CAUSE OF EVENT:

The immediate cause of the depressurization event was the disengagement of the feedback arm linkage from the pressurizer spray valve controller. The root cause of the event was maintenance personnel error due to not adequately tightening the linkage and not adequately verifying that the linkage had been properly reassembled. The root cause of the automatic reactor trip was the operators' failure to properly assess Plant conditions and manually trip the reactor prior to the automatic trip.

The cause of the Technical Specification 3.3.2 violation was that the operators exited the Emergency Operating Procedure with all safety injection trains blocked in mode 3 in violation of Technical Specifications. The operators did not consider that the design feature of t
e safety injection block would place the plant in this condition.

ANALYSIS OF EVENT:

Reactor trips and safety injections are reportable under 10CFR50.73 (a)(2)(iv).

The Unit 2 depressurization transient is bounded by the Inadvertent Opening of a Pressurizer Safety or Relief Valve event discussed in Section 15.6.1 of the Updated Final Safety Analysis Report (UFSAR). The results of the analysis show no fuel failure occurs as a result of the depressurization.

The causes of the event are known and the plant responded as designed. However, as discussed in the Description section, the pressurizer spray response under various RCP operation combinations was not expected and must be fully addressed in plant documents and procedures.

Westinghouse guidance used for development of operating procedures and training indicates that stopping the RCP in an affected spray loop will stop spray flow and depressurization. This guidance did not consider the impact of the fourteen (14) foot core and 8000 horsepower (hp) RCP motors at the South Texas Project (STP). STP hydraulic studies, after the event, indicate that the large core and RCP motors require that three RCPs be secured, as in this event, before pressurizer spray flow is stopped. The South Texas Project units are the only fourteen foot Westinghouse cores in the United States.

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ANALYSIS OF EVENT: (Con't)

Since the safety injection reset function and the contents of the Westinghouse Owners' Group (WOG) Emergency Response Guidelines (ERGs) are generic, conversations were held with the WOG that centered on the need to include the issue of the automatic safety injection block in the Emergency Response Guidelines. Additionally, HL&P sent a letter to the WOG to inform them of this Technical Specification conflict. On August 13, 1992, a meeting of the ERG Sub-committee was held. A decision was made by the Sub-committee to dismiss this issue because the problem did not fall under the ERG scope. A formal vote on this issue is expected in the near future.

CORRECTIVE ACTIONS:

In response to the plant trip, the following actions have been or are being taken:

1. Locking nuts were added to spray valve feedback arm linkage connecting screws in both units. This action is expected to preclude feedback arms from disengaging in the future.

2. An operating policy statement has been issued regarding operation during off-normal and emergency conditions which requires operators to avoid unnecessary challenges to and reliance upon plant actuation systems. The policy will help to ensure that a conservative approach is used by Operations to avoid automatic plant trips.

3. The Plant Manager has reviewed this event with Shift supervisors and emphasized management's policy regarding operation during off-normal and emergency conditions.

4. To reinforce the lessons learned from this event, which include management expectation that operators avoid reliance on automatic trip functions and lack of attention to detail in proper reassembly of the controller, training was provided through the following programs:

Licensed Operator Initial and Requalification (Requal)
Non-Licensed Operator Initial and Requal
Management and Technical Staff new and continuing training
Maintenance I&C, Electrical, Mechanical continuing training

CORRECTIVE ACTIONS: (Con't)

5. Maintenance planners are directed, through a Planner's Guide, to include relevant vendor manual pages with work packages and to direct the performer to stop work if the field installation is different and document the deviation as a non-conformance report. Plant procedures were revised to formally implement this requirement.

6. To verify proper configuration control, Engineering shall inspect a sampling of other pneumatic valve actuators and attached controllers, compare them to the vendor manuals (design documents), and verify the adequacy of the installations. This task will be completed prior to the end of the next refueling outage for each Unit.

7. Hydraulic studies have been completed to explain and establish the reactor coolant pump (RCP) configuration required to stop spray flow under conditions of spray valve failure. The appropriate plant documents, procedures, and training were revised.

The following actions have been taken as a result of the Technical Specification 3.3.2 violation.

1. The Emergency Operating Procedure was revised to reset the Safety Injection permissive prior to exiting the procedure.

2. An evaluation will be performed to identify other Emergency Operating Procedures which may unknowingly place the plant in a Technical Specification action statement. This evaluation will be completed by November 3, 1992. Additional corrective actions will be developed as necessary.

3. Licensed Operator Requalification training will be conducted on the circumstances surrounding this event. This training will be completed by February 26, 1993.

4. Training will be conducted on the Simulator that recreates this event with emphasis placed upon the need to evaluate differences between actual plant conditions and Technical Specification requirements when transitioning from an EOP to a normal operating procedure. This training will be completed by February 26, 1993.

CORRECTIVE ACTIONS: (Con't)

5. Conversations were held with the Westinghouse Owners' Group to discuss the need to include the issue of automatic safety injection block in the WOG Emergency Response Guidelines. Additionally, HL&P has sent a letter to the WOG to inform them of this generic problem with the Technical Specifications. HL&P has recommended to the WOG that a network bulletin be sent out to other Westinghouse plants.

ADDITIONAL INFORMATION:

The feedback arm linkage described in this event is a Bailey Control Systems, type AP2 Characterizable Pneumatic Positioner. The valve to which it is connected is manufactured by Fisher. The complete assembly was provided to South Texas by Westinghouse.

Unit 2 LER 90-012 documents an investigation into a feedwater regulating valve feedback arm linkage disengagement event at South Texas Unit 2 which resulted in a steam generator overfill and feedwater isolation event. The cause of LER 90-012 was inadequate maintenance. The corrective actions were limited to inspections and adjustment of feedwater regulating valves and feedwater regulating bypass valves, and a maintenance training bulletin on the "Importance of Proper Tightening of Terminations and Hardware Fasteners". The corrective action taken for LER 90-012 did not prevent this event from occurring. Prior to this event the corrective action program at South Texas was under review by executive management. A recommendation to revise the program is being implemented to create a new corrective action group reporting to the Plant Manager utilizing Event Response Teams for significant plant events.

Spray valve transients have occurred at Crystal River (1991), Diablo Canyon (1990), and Indian Point (1984 & 1985). Some of these events involved mechanical binding caused by valve stem deformation. Others involved disengagement of feedback arms.

HL&P has requested that Westinghouse review this event for 10CFR21 reportability in light of similar incidents in the industry. In response, Westinghouse has formally initiated a Potential Issue evaluation.

The Light
company South Texas Project Electric Generating Station
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Houston Lighting & Power

September 23, 1992
ST-HL-AE-4219
File No.: G26
10CFR50.73

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

South Texas Project
Unit 2
Docket No. STN 50-499
Revision 1 to Licensee Event Report 91-010
Regarding Automatic Reactor Trip and Safety
Injection Actuation due to Low Pressurizer Pressure

Pursuant to 10CFR50.73, Houston Lighting & Power (HL&P) submits the attached Revision 1 Licensee Event Report 91-010 regarding an automatic Reactor Trip and actuation of the Safety Injection system due to low pressurizer pressure. This event did not have adverse impact on the health and safety of the public.

This revision incorporates additional information that was discovered after the original LER was submitted. This letter includes additional information on the second depressurization event and information on a Technical Specification 3.3.2 violation that also occurred during this event.

If you should have any questions on this matter, please contact Mr. C. A. Ayala at (512) 972-8628 or me at (512) 972-7205.

William J. Jump
General Manager,
Nuclear Licensing

JMP/ag

Attachment: LER 91-010 Rev. 1 (South Texas, Unit 2)

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Revised 10/11/91
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